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MAN. NANOVIP PLUS - Eng - Rev. 01/2012

Product 100% Made in Italy

ENGLISH

elcontrol® energy net

Power in Control

NANOVIP - NANOVIP PLUS

USER MANUAL

NANOVIP

USER MANUAL

1 OPERATORS SAFETY

This instrument was constructed and tested according to standard IEC 348 class 2 for voltages up to 600 VAC and complies with [insulation] standards VDE 0110 group C for operating voltages up to 550 VAC and IEC 1010 600 V CAT III with regard to category III installation and level of pollution 2 under IEC 664 - 664 A, and was shipped from the factory in perfect operating condition. In order to preserve these characteristics and to insure safe operation, the user must follow the instructions contained in this manual.

Before performing any service operation, repairing, part replacement or battery substitution, the instrument must be disconnected from any voltage source.

After determining that the instrument is not operating correctly, it must be withdrawn from service and cautions must be taken to prevent unintentional operation.

Instrument operation is not recommended when any of the following conditions may occur:
- the instrument exhibits clear damage
- The instrument doesn't operate at all
- After a long storage period in unfavorable conditions.
- After suffering damages during transportation

Read this manual carefully before installing and using the instrument.

1.1 Introduction

The instrument described in this manual has been designed to be used by qualified personnel. Service or troubleshooting operations must be conducted by authorized personnel only.

1.2 Safety cautions

In order to guaranty safe operation [of the instrument], it is necessary that the service personnel comply with standard safety procedures during troubleshooting and repairing operations.

1.3 Symbols

READ THE INSTRUCTIONS

1.4 Cautions in case of malfunction

When the operator suspects that the equipment is not safe, for example, due to demange sustained during transportation, or during routine operation, it must be withdrawn from service, and unintentional operation must be prevented. Qualified personnel must be called for troubleshooting and repairing.

1.5 Cleaning instructions

After ensuring that the instrument is isolated or disconnected from supply and measurement circuits, the outside of the container may be cleaned using a soft damp cloth (water only). Do not use abrasives or solvents. Never allow water to wet the terminals or enter the instrument.

2 FEATURES

2.1 General features

NANOVIP is a portable instrument that enables you to measure: Voltage (volt rms), Current (amp rms) P.F. Cosf, Active Power (watt), Reactive Power (var), Apparent Power (VA), Frequency (hertz).
DC voltages can be measured directly by means of the safety voltage leads provided with the instrument. DC currents can be measured using the Hall effect current clamps, available from ELCONTROL ENERGY.

NANOVIP includes also two functions (PEAK and MEM) which are very useful in analyzing electrical plants.
The PEAK function enables you to measure the maximum/minimum values* obtained by the instrument referring to the instant in which the push-button PEAK was pressed, for any of the 3 following measurements:

Amperes (Max. value)
Watt (Max. value)
Volts (Min. value)

which can be selected in the sequence shown above using the SEL push-button.

* *See note - Pag. 21*

The function MEM enables you to measure and display the differences between the present values of Volts, Amperes, and Watt and the values in memory. (Stored when the MEM push-button is pressed).

2.2 Great versatility

The NANOVIP is a very portable instrument of ergonomic design, product of ELCONTROL experience in the design of Power instrumentation systems. The NANOVIP provides accurate measurements in the 7W to 150 KW power range with a 200A/1 V current clamp; and from 35W to 750 kW in single-phase connection with a 1000A/1 V current clamp (1.299 MW in threephase connection).
It has a system that automatically recognizes the type of current clamp, and switches between the two types of current clamps, making its operation extremely simple.

2.3 Features and applications

The ELCONTROL NANOVIP offers a set of features which are useful to a wide spectrum of users including plant designers, electricians, etc. during applications that include troubleshooting, operation, or remodeling of existing plants. It is also very useful to electrical energy users who desire to gain a better understanding of plant operation.

The NANOVIP set of features enable you to perform additional applications which include:

- Control of loads and consumption;
- Reduce overload and losses in the plant;
- Verify (while in service) the correct design of new plants;
- Prevent the risks of overheating and lack of isolation in the plant;
- Solve in an efficient way the problems of power factor;
- Detection and reduction of peaks of load and power consumption;
- Control of UPS systems by measuring the AC at the inputs and outputs;
- Measurement in presence of distorting signals.

2.4 Instrument description

2.4.1 Front panel

1: LCD for displaying the measurements obtained.
2: SEL push-button for selection of the maximum/minimum quantity* (V, I, W) that the user desires to display.
3: PEAK push-button to display the Voltage (V); Current (I) and Active Power (W).
4: MEM push-button to recall the function of the same name. The function MEM enables you to measure and display the differences between the present values of Volts, Amperes, and Watt and the values in memory. (Stored when the MEM push-button is pressed).
5: PAG. push-button to select between the two measurement pages that display the seven fundamental quantities. When the PEAK function is active, it enables display of the second measurement page referring to maximum/minimum values. When the MEM function is active, it provides the capability of displaying the differences corresponding to the second page.
6: ON/OFF switch.
7: 3f/1f switch. Switch position must correspond to the kind of system where the instrument is being used. (3f =three-phase, 1f =single-phase)

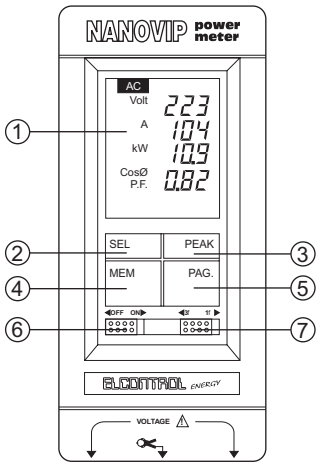


Fig. 2.1

* See note - Pag. 21

2.4.2 Rear Panel

1: Adjustable support for the instrument on a working surface.
2: Battery compartment cover, with multilingual label and characteristics of the batteries to be employed.
3: Battery compartment for powering the instrument (Four 1.5V AA batteries).

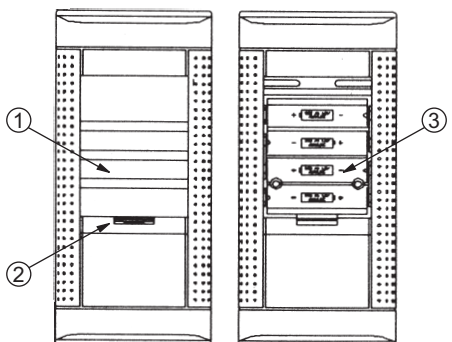


Fig. 2.2

2.4.3 Measurement connections

1: Voltage input terminals. The safety voltage leads include test probes with protective cover and protected banana plug.
2: Current Clamp input socket.

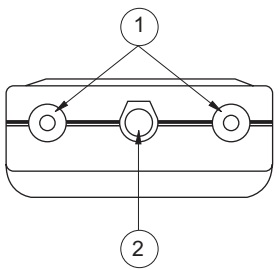


Fig. 2.3

2.5 Handling the instrument

2.5.1 Support tab

The tab located on the rear panel can be pulled and used as support to place the instrument on a working surface.

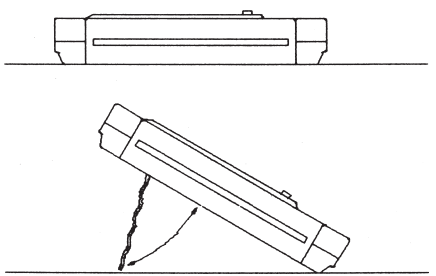


Fig. 2.4

2.5.2 Protective cover

The NANOVIP is provided with an ABS antishock protective cover signed to permit the insertion of one of the test probes as shown in Fig. 2.5.

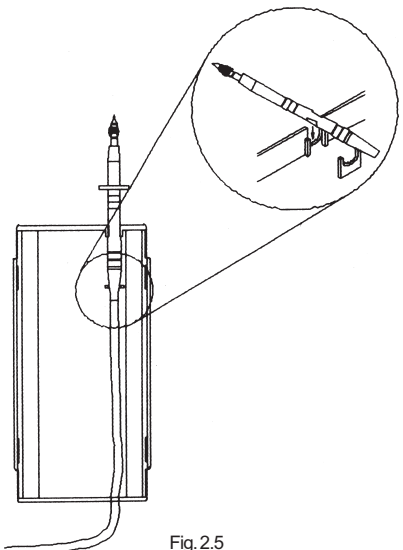


Fig. 2.5

The instrument can be inserted in the protective cover as shown in Fig. 2.6

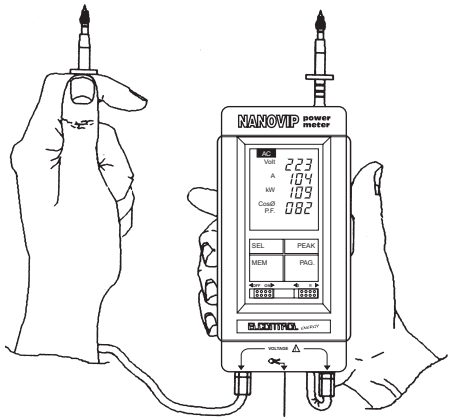


Fig. 2.6

3 OPERATING INSTRUCTIONS

3.1 Preliminary instructions

After receiving the instrument, please verify that the package is complete and check for damaged parts (during transport). Check also all of the items against the packing list. In case of problem please contact the ELCONTROL ENERGY representative.

3.2 Packing list

1 Carryng case for NANOVIP Kit
1 NANOVIP POWERMETER
1 Set of safety voltage leads
1Current clamp 200A/1V with cable
4 Piles 1.5V (size AA)
1 Guarantee certificate
1 Instruction manual

3.3 Safety instructions

The maximum input voltage that can be applied to the voltage (measuring) input channel is 600 VAC. In order to guaranty the maximum conditions of safety, it is recommended to use (exclusively) the set of safety voltage leads provided with the kit because of their rated insulating characteristics (tested in accordance to standard VDE 0110, group A for operation voltages up to 1000V; and provided with protected banana plugs for insertion in the instrument).

3.4 Powering the instrument

The NANOVIP is powered by four AA 1.5V batteries. The batteries are placed on the rear of the instrument under the supporting tab.
Fig. 3.1 shows the proper way for installing the batteries.

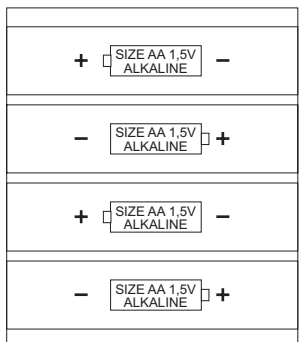


Fig. 3.1

3.4.1 Indication of discharged batteries

The instrument performs a control on the battery voltage. When it crosses the discharge threshold, the message BAT (which warns that the batteries are very close to total discharge) appears on the LCD display. Battery replacement is recommended under these conditions (see Fig. 3.2).

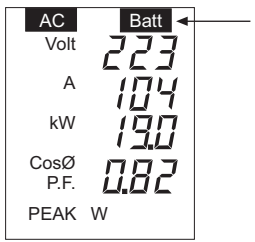


Fig. 3.2

For example, when using Alkaline-Manganese IEC LR6 batteries (nominal capacity 2700mAh) there is an approximate autonomy of 50-60 hours in continuos operation (40-50 hours in the case of PEAK function operation). The duration is longer in case of discontinuos operation.

The autonomy of the instrument after the appearance of the warning message on the display up to the moment when the batteries become fully discharged (and the instrument becomes non-operative) depends on the quality of the batteries.

3.5 Connecting the instrument

3.5.1 Voltage measuring connections

The Voltage measuring connection is done using the safety voltage leads provided with protected banana plugs for connection to the instrument (see Fig. 3.3). The maximum voltage that can be applied can not exceed 600 VAC.

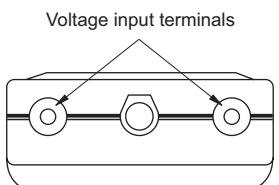


Fig. 3.3

3.5.2 Current measuring connection

The current measuring connection is done using the current clamp provided in the kit, or 1000A/1V current clamp (such as the Number Code 4AAA6 distributed by ELCONTROL ENERGY).
The connector must be inserted in the respective input socket.

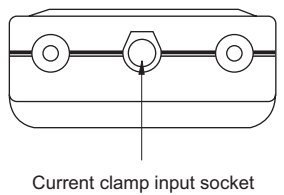


Fig. 3.4

In case of clamps with 1A output, for example the clamp 1000/1-D5 distributed by ELCONTROL ENERGY (Code 4AAC2), use the interface INTA/1 offered as an optional accessory (Code 4AABB).

4 APPLICATIONS

4.1 Connection to single phase networks

Set the switch “3f 1f” in the 1f position. Connect the instrument such as illustrated in Fig. 4.1.

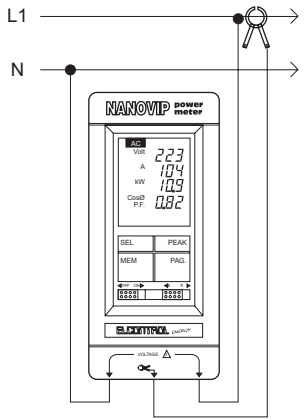


Fig. 4.1

4.2 Connection to three-phase networks

To connect the instrment to a balanced three-phase system, set the switch "3f 1f" in the position 3f. Connect the instrument such as illustrated in Fig.4.2.

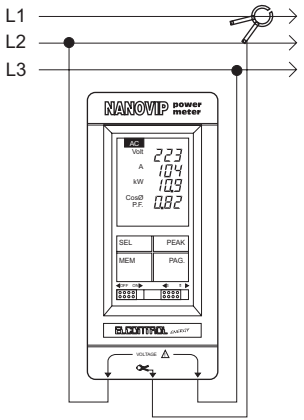


Fig. 4.2

4.3 Application as a current clamp meter

The NANOVIP may be used as a current clamp meter for a direct reading of current measurements (see Fig. 4.3).

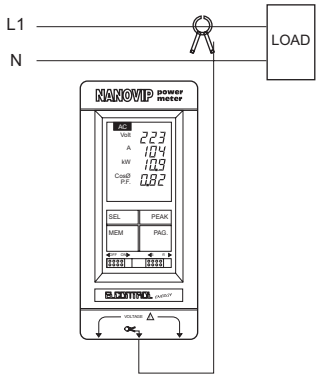


Fig. 4.3

4.4 Application for measurement of DC voltages and currents

DC currents can be measured using the 1000A/1V AC-DC Hall effect current clamp that is connected to the NANOVIP through the interface ADAPTA 1V/1V (Code 4AACQ). See Fig. 4.4.

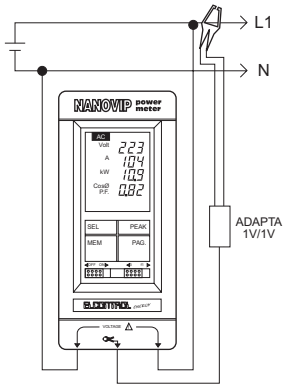


Fig. 4.4

The voltage measurement and current measurement connections don't depend on the polarity, because the RMS value provided by the NANOVIP doesn't show the sign of the voltage or the current being measured.

5 INSTRUMENT OPERATION

The ELCONTROL NANOVIP is an instrument that enables you to measure and display the seven fundamental quantities.
The functions are related to the push buttons and the LCD placed on the front panel of the instrument.

5.1 Turn on and turn off

• ON/OFF: Turn on the instrument by setting the slide-switch in the "on" position.

The first measurement page appears by default on the display.

The instrument is turned off (and all the measurement data is lost) when the slide switch is set to the off position.

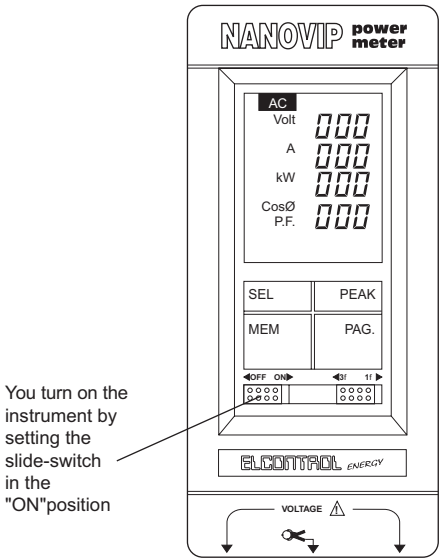


Fig. 5.1

5.2 SINGLE-PHASE and THREE-PHASE measurements set-up

• **3f**/**1f**: This slide-switch enables the user to select the operation either in single phase systems or in balanced three-phase systems. Set the slide switch in the "3f" position to perform measurements in balanced three-phase systems, or in the "1f" position for measurements in single-phase systems (see Fig. 5.2).

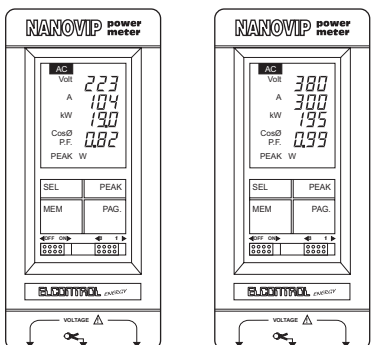


Fig. 5.2

5.3 Displaying measurement pages

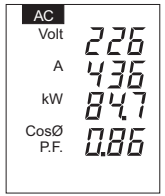
• **PAG.:** The PAG. push-button enables the user to select the second measurement page related to the measurement that has been made.
The PAG. function is monostable. Therefore it is active only while the (respective) push-button is pressed.
The first measurement page (related to the quantities Volts, Amps, Watts and Cosf) appears on the display when the instrument is turned on. To select the second measurement page you must press the PAG. push-button, then the measurement of Var (Reactive Power), VA (Apparent Power), and Hz (Frequency) will appear on the display.
Once the PAG. push-button is released, the instrument returns to (display) the first measurement page.

5.3.1 First measurement page

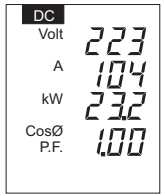
Volt: AC/DC voltage with a full-scale value of 750 Vrms.
Amps: AC/DC current with a full scale value of 200A or 1000A (depending on the type of clamp employed) equivalent to 1Vrms appearing at instrument input terminals.

Watt: Active power with a full scale value equal to VxA.
Cosf P.F.: Power factor with an active range varying from -0.00 (a purely capacitive load) to +0.00 (a purely inductive load).
The display will show the AC or DC symbol depending on the kind of voltage (AC or DC) measurement being conducted.

First measurement page AC

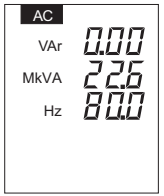


First measurement page DC

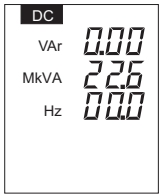


5.3.2 Second measurement page
Var: Reactive power.
VA: Apparent power.
Hz: Frequency of the power system. Range from 20 to 600 Hz.
The display will show the AC or DC symbol depending on the kind of voltage (AC or DC) measurement being conducted.

Second measurement page AC



Second measurement page DC



5.4 PEAK function*
*NOTE: the "peak" term is used to indicate:
- maximum value of Active Power
- maximum value of RMS current
- minimum value of RMS voltage

• PEAK: This push-button provides the capability of measuring and displaying the conditions of maximum and minimum as related to RMS current (Amps), Active Power (Watts), and RMS Voltage (volts) during a sampling interval which is initiated by the operator by pressing the PEAK push-button.
In the PEAK mode, the instrument performs measurements at a faster rate and is able to provide readings of maximums and minimums with a duration equal to or greater than 0.4 seconds.
This function is specially useful for measuring the values of motor start up current, undervoltages and maximum values of consumption (power).
The symbol PEAK appears on the display during the operation in the PEAK mode (see Fig. 5.3).

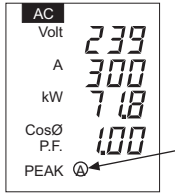
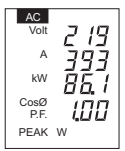


Fig. 5.3

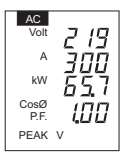
The PEAK push-button is bistable, that is the function remains active until the push-button is pressed again. The instrument memorizes all the measurements coinciding with the Minimum/Maximum of the selected quantity A (Max. Amps), W (Max. Watts), V (Min. Volts). The selection of the quantity to be analyzed (by the PEAK function) is done through the SEL push-button.
The PAG. push-button is used to display the quantities in the second measurement page (related to the quantity under analysis with the PEAK function).
The Maximum/Minimum values are updated automatically during the time that the instrument operates in the PEAK mode.
Attention: During operation in PEAK mode, the battery consumption increases by approximately 25%

• SEL: This push-button enables the user to select the quantity to be analyzed with the PEAK function. This push-button is enabled (only) when the PEAK function is active.
By pressing the SEL push-button, the user can select the quantity (to be analyzed by the PEAK function) in the following sequence: Amperes (by default it appears as the first quantity), Watts and Volts.
The symbol (identifying) the selected quantity (A=Amperes, W=Watts and V=Volts), appears on the display, close to the PEAK symbol.

Second page of PEAK function (Power)



Third page of PEAK function (Voltage)



5.5 Measurement of deviations

• MEM: This push-button enables you to memorize the measurement at a specific point in the plant, or at a given time. The display will show the difference between the (memorized) values of Voltage (V), Current (A) and Power (W) and the values being measured to the present time (see Fig. 5.4).
The display shows the four measurements obtained when the MEM push-button was pressed and the MEM symbol in order to identity the function.

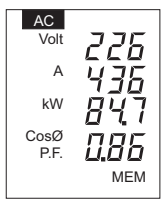


Fig. 5.4

The differences between the (memorized) sample values and the present measurements are shown when the PAG. push-button is selected.

The differences (shown) may be positive (in this case the present measurement value is greater than the value in memory) or negative (indicating that the present measurement is lower than the reference value). The value of CosΦ is not shown on this page.

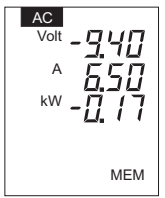


Fig. 5.5

To exit from this function, the MEM push-button must be pressed again. This function is useful when the measurements are done to compare with (previously) measured values.
For example for measuring the difference between the starting point and the end point of a power line it is useful for evaluating the losses through the line.

6 TECHNICAL CHARACTERISTICS

6.1 General specifications

• Input channels:
Voltage: (L1,N) max 600 VAC (20 Hz - 600 Hz)
Current: 1 Volt (20 Hz - 600 Hz.)
• Overload of voltage input channels:
maximum permitted voltage 825VAC,1.17 KV peak.
• Overload of current input channels:
5 times Full scale value (a protective device trips when this limit is reached).
• Ranges:
3 voltage ranges, 3 current ranges.
• Automatic scale change:
Response time for scale change: 1 sec.
The change to the next (higher) scale occurs at
105% of full scale value of the scale activated.
The change to the next lower scale occurs at 20% of full scale value of the scale activated.
• Dimensions (mm.):
80 x175 x 32,5 (without cover).
• Weight:
400 gr. including cover and batteries.
• Kit weight:
1,6 Kg.

6.2 Service and test conditions

• Degree of protection:
IP40 (IEC 529)
• Container:
ABS anti-shock class VO.

• Operating temperature:
-10°C to 50°C
• Humidity (non-condensing):
20% to 80% R.H.
• Storage temperature:
-20°C to 60°C
• Insulation:
to VDE 0110 group C for operating voltages 500 VAC
• Insulation resistance:
500 Mý between short-circuited input terminals and the case
• Insulation voltage between voltage input terminals:
Test voltage= 2000V for 60 seconds
• Insulation voltage between each voltage input terminal and case:
Test voltage= 3000V for 60 seconds
• Standards:
IEC 348, VDE 0411 class 2, for low voltage circuits - 600 VAC. IEC 1010 600V CAT III level of pollution 2.
• EMC reference standards:
EN 50081-1, EN50082-2, EN 55022

6.3 Power

• Battery type: 1,5V AA alkaline-manganese IEC LR6, nominal capacity 2700mAh
• Battery life: 50-60 hours typical; 40-50 hours when
PEAK function is activated.

6.4 Measurement of fundamental quantities

• Measurement technique:
fixed sampling and A/D conversion
• Sampling frequency:
1.25 KHz.
• Number of samples:
250 (200 mS)
• Measurement rate:
1second in normal operation, 0.4 second in PEAK
mode
• Zero self-regulation:
every minute

6.5 Fundamental quantities measurement accuracy

- Measurement error at 40% to 60% R.H. and ambient temperature (from 18°C to 25°C) after a 10 minutes warm up period (see table). Additional measurement errors outside this range: ± 0.02% of Full scale value per degree out of range.
- Resolution and accuracy of voltage measurement (sinusoidal signal from 45Hz to 65Hz):
- Direct input with maximum voltage=750 Vrms at Full Scale.
  Input Voltage Crest Factor >1.6.
  Input impedance > 4Mohm.

Resolution, Full Scale and accuracy of voltage			
Range	Resolution	Full Scale (*)	´ da 20%F.S. a 100% F.S.
20 Vrms	13mV (**)	20 V	0,5 %F.S. +0,5%Lt.
50 Vrms	32 mV	50 V	0,3 %F.S. +0,3%Lt.
150 Vrms	96mV	150 V	0,3 %F.S. +0,3%Lt.
750 Vrms	480mV	750 V+10%	0,3 %F.S. +0,3%Lt.

(*) The minimum measurable signal is 1V.

- Resolution and accuracy of current measurements (sinusoidal signal from 45 to 65 Hz): Direct input with voltage = 1VAC at Full Scale.
  Crest Factor of input signal >3.
- The accuracy does not take into account the current clamp error.
- Accuracy of voltage and current measurements as function of frequency:
  for frequencies in the 20-90 Hz range: 1.5% Rdg. (V, F); at 600Hz: 3% Rdg. (I); 2% Rdg. (V).

Resolution, Full Scale and accuracy of current			
Range	Resolution	Full Scale (*)	´ da 20%F.S. A 100% F.S.
35mV	22,4uV (*)	35A	0,5 %F.S. +0,5%Lt.
71mV	45uV	71A	0,3 %F.S. +0,3%Lt.
175mV	112uV	175 A	0,3 %F.S. +0,3%Lt.
350mV	224uV	350 A	0,3 %F.S. +0,3%Lt.
544mV	348uV	544A	0,3 %F.S. +0,3%Lt.
1000mV	640uV	1000A+10%	0,3 %F.S. +0,3%Lt.

(*) Full Scale values correspond to:
7,0-14,2-35,0-70,0-108,8-200 Amps with 200A/1V clamp
35,0-71,0-175-350-544-1000A with 1000A/1V clamp

(**) The minimum measurable signal is 2mV corresponding to 0.4A (200A/1V) or to 2A (1000A/1V).

• Measurement accuracy for secondary quantities: Maximum error for active power, P.F. Cosf, Active energy: class 1 IEC 1036.

• Measurement of other secondary quantities: The error is expressed by the formula which defines the quantity as function of V and I.

Frequency measurement	
Frequency range	
30 ÷ 100Hz	0.05% Rdg. ±0.1Hz
101 ÷ 500Hz	0.3% Rdg. ±0.1Hz
501 ÷ 600Hz	0.5% Rdg. ±0.1Hz

6.6 Formulae

6.6.1 SINGLE-PHASE

RMS Voltage: $V_{1N} = \sqrt{\frac{1}{n} \cdot \sum_{1}^{n} (V_{1N})_i^2}$

Active power: $W_1 = \frac{1}{n} \cdot \sum_{1}^{n} (V_{1N})_i \cdot (A_1)_i$

Power factor: $\cos\phi_1 = \frac{W_1}{VA_1}$

RMS Current: $A_1 = \sqrt{\frac{1}{n} \cdot \sum_{1}^{n} (A_1)_i^2}$

Apparent power: $VA_1 = V_{1N} \cdot A_1$

Reactive power: $VAr_1 = \sqrt{(VA_1)^2 - (W_1)^2}$

NOTE: $(v_{1N})_i$ $(a_1)_i$ $(v_{23})_i$ = samples of voltage and current

6.6.2 THREE-PHASE

RMS Voltage: $V_{23} = \sqrt{\frac{1}{n} \cdot \sum_{1}^{n} (V_{23})_i^2}$

Active power: $W = \sqrt{(VA)^2 - (VAr)^2}^2$

Power factor: $\cos\phi = \frac{W}{VA}$

RMS Current: $A_1 = \sqrt{\frac{1}{n} \cdot \sum_{1}^{n} (A_1)_i^2}$

Apparent power: $VA = \sqrt{3} \cdot V_{23} \cdot A_1$

Reactive power: $VAr = \sqrt{3} \cdot \frac{1}{n} \cdot \sum_{1}^{n} (V_{23})_i \cdot (A_1)_i$

NOTE: $(v_{1N})_i$ $(a_1)_i$ $(v_{23})_i$ = samples of voltage and current

NANOVIP PLUS

USER MANUAL

1 INTRODUCTION

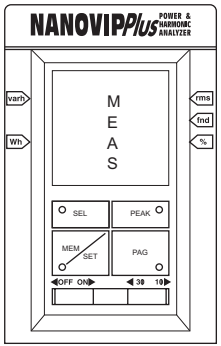
The NANOVIP PLUS is a hand-held portable instrument which supplies all the information provided by the NANOVIP base model:
Voltage (V rms), Current (A rms), P.F. CosØ, Active power (W), Reactive power (var), Apparent power (VA), Frequency (Hz), Variations in V, I, W, of the memorised values (MEM function, frozen values of the mean measurements in correspondence with the max. A or W values or the minimum V value (PEAK function), DC measurements with optional Hall effect clamp meters.
As well as all the measurements envisaged by the basic version, the NANOVIP PLUS offers many additional functions the total number of measurements is over 100:

- Active energy (kWh) and reactive energy (kvarh) meters in Standard or Cogeneration version (kWh and positive and negative kvarh meters);
- Total Harmonic Distortion Factor (THD) of V and I in relation to the fundamental and the total rms value;
- V harmonics and the value of CosØ from the 1st to the 24th plus their DC component (i.e. Ø harmonic) in absolute value and as percentage of the fundamental;
- Crest factor of V and I as absolute value and percentage;
- DC Ripple of V and I as absolute value and percentage of the DC value;
- RS232 serial communications port for connection to PC with choice of settings of:
  19.2, 9.6, 4.8, 2.4, 1.2, Kbaud
  7/8 data bits
  1/2 stop bit
  no/odd/even parity

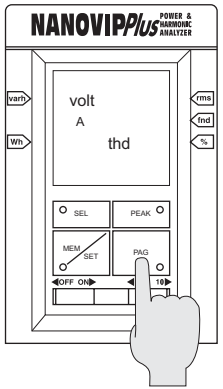
These functions are useful for a wide range of applications which include:

- Control and optimisation of load electrical consumption levels;
- Analysis of the harmonic distortion caused by non linear loads;
- Prevention of the risk of resonance between banks of power factor correction capacitors and power supply transformers;
- Verification of the DC ripple (residual ripple of direct current power supply units);
- Acquisition of data on Personal Computer for compilation of graphic and numerical reports on tests on electrical machines and systems.

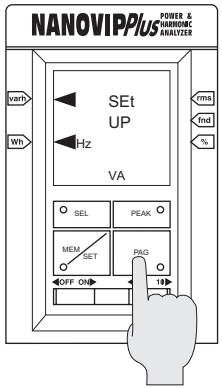
2 LIST OF MENUS



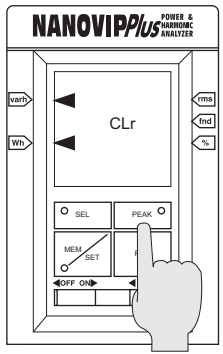
MAIN MEASUREMENTS menu
Press the PAG. key for 3 seconds to pass from the measurement pages to the list of menus.
To access the main measurements menu press SEL.
To scroll through the list of menus press PAG.



HARMONICS ANALYSIS menu
To access the menu press SEL.
To scroll through the list of menus press PAG.

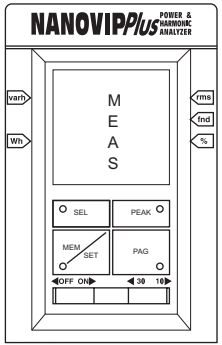


SET UP menu
To access the menu press SEL.
To scroll through the list of menus press the PAGE key again.

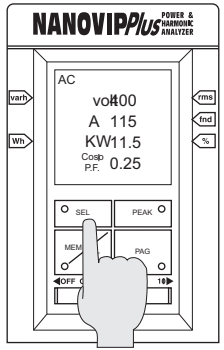


Energy Meter RESET menu
To access the menu press SEL.
To scroll through the list of menus press PAG.

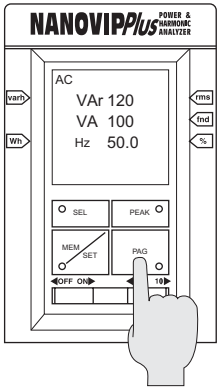
3 MAIN MEASUREMENTS MENU



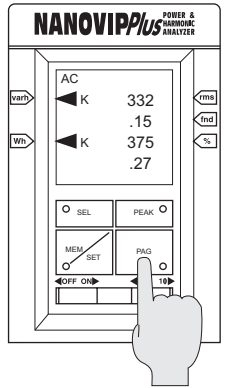
To display the pages press SEL.



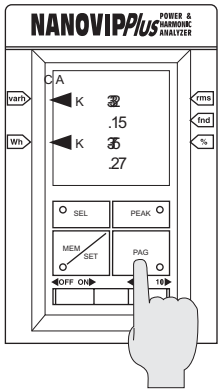
Instantaneous measurements of Volt, Amps, Watt, P.F.
To continue scrolling through the pages of this menu press PAG.
To exit from this menu keep the PAG. key pressed for at least 3 seconds.



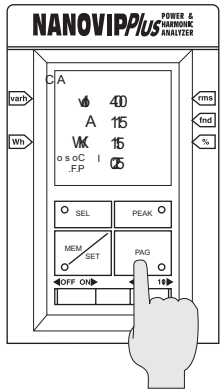
Instantaneous measurements of var, VA, Frequency.
The Hz range is from 0 (DC) to 999 Hz (AC).
Below 20 Hz, DC appears instead of AC.
To continue scrolling through the pages of this menu press PAG.



Positive Active Energy and positive Reactive energy meters.
Min 0.01 kWh kvarh
Max. 999.99 MWh Mvarh
To save the values of all meters (positive and negative) press MEM (the word MEM will appear for a moment).
To continue press PAG.

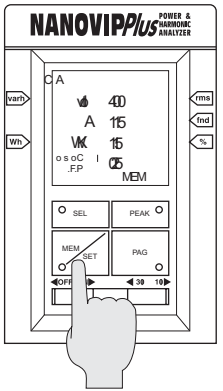


Positive Active Energy and positive Reactive energy meters.
Min 0.01 kWh kvarh
Max. 999.99 MWh Mvarh
To save the values of all meters (positive and negative) press MEM.
To continue press PAG.

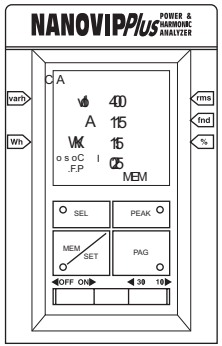


From the first and second main measurements page, the user may access the MEM and PEAK functions described in the pages which follow.

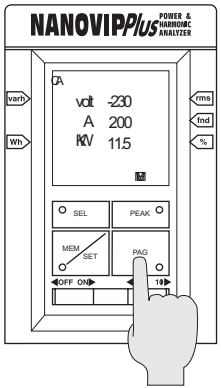
3.1 MEM FUNCTION



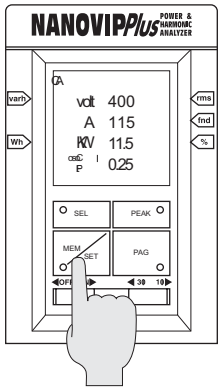
To access this function, press MEM/SET with measurements page 1 or 2 on the screen.



This button allows the user to save the measurements at a given point of the system and then to display the differences between the saved measurements of V, I and P and the updated measurements which the instrument continues to make.
The display shows the four measurements made at the moment when the button was pressed and MEM to identify the function.

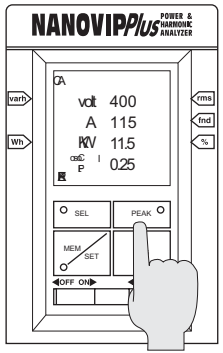


When the PAG. key is pressed, the display shows the differences between the saved measurements and those made by the instrument.
The differences shown may be positive or negative.
This page does not show the P.F. value.

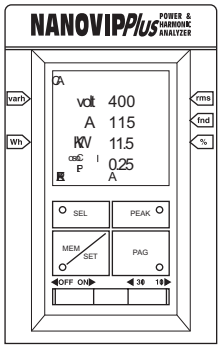


To exit from this function and return to the main measurements, press the MEM/SET button again.

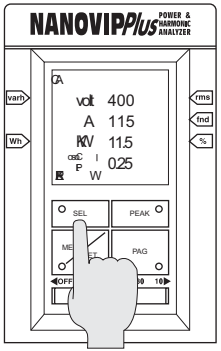
3.2 PEAK FUNCTION



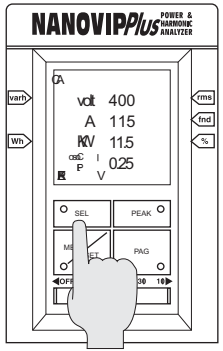
PEAKS MEASUREMENT
To access this function press the PEAK key with measurements page 1 or 2 on the screen.



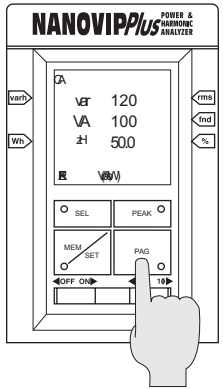
When the PEAK button is pressed, the instrument shows the “snap-shot” taken at the moment of the maximum RMS current value, the maximum Active Power value or the minimum RMS voltage value.
In PEAK mode, the instrument makes measurements more quickly and is able to detect phenomena lasting 0.4 seconds or more. Harmonics calculation is disabled.
This function is especially useful when measuring the current surges when motors are started, voltage drops and power peaks.



PEAKS MEASUREMENT
In the initial setup, the instrument takes a “snap-shot” at the moment of the maximum current value.
When the SEL key is pressed again, the instrument takes a “snap-shot” at the moment of the maximum active power value

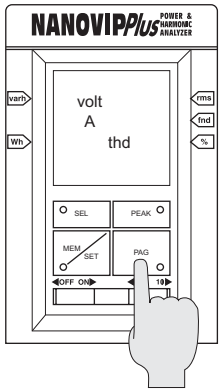


When the SEL key is pressed a third time, the instrument takes a “snap-shot” at the moment of the minimum RMS voltage.
Press the SEL key again to return to the “maximum current value” mode.
Press the PEAK key to return to the main measurements pages.
Press PAG to move on to the next page.



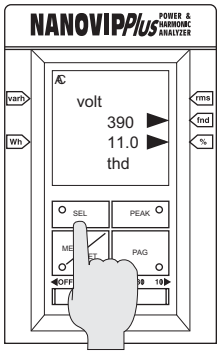
Var, VA and frequency measurements of the latest measurements “snap-shot” taken.
The frequency range is from 0 (DC) to 999 Hz (AC).
Below 20 Hz DC appears instead of AC.
Press the PEAK key to return to the main measurements pages.

4 HARMONICS ANALYSIS MENU

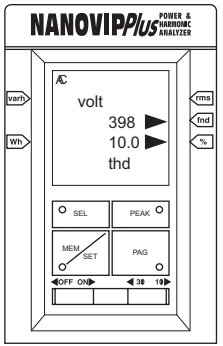


To scroll through the list of menus press PAG.

N.B.: this menu only appears if the frequency of the fundamental has been selected in the SET-UP.



To access the menu press SEL.

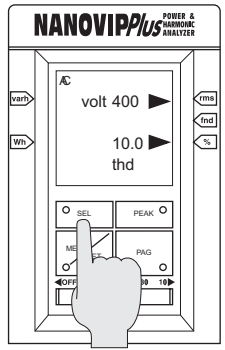


Percentage Total Harmonic Distortion Factor of the Voltage in relation to the fundamental(THD). Varies from 0 to 999%. Updated every 24 seconds.

$$THD\ V = \sqrt{\frac{(S_{k=2,24} V_k^2)}{V1}}$$

Where: V1 = fundamental
V_k = harmonic k

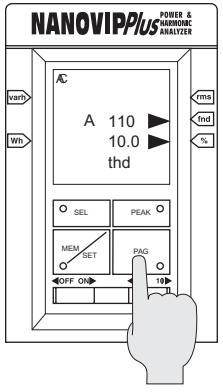
Keep the SEL key pressed to display the THD referred to the RMS value. Press PAG. to move on to the next page.



Percentage Total Harmonic Distortion Factor of the voltage referred to the RMS value.
Varies from 0 to 100%. Updated every 24 seconds.

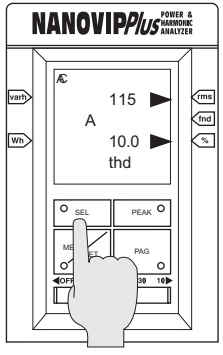
$$THD\ V = \sqrt{\frac{(S_{k=2,24} V_k^2)}{Vrms}}$$

Release the SEL key to return to the previous page.



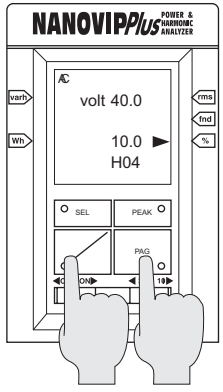
Percentage Total Harmonic Distortion Factor of the current in relation to the fundamental.
Varies from 0 to 999%. Updated every 24 seconds.
Keep the SEL key pressed to display the THD in relation to the RMS value (one stable reading).
Press PAG. to move on to the next page

$$THD\ I = \sqrt{\frac{(S_{k=2,24}\ I_k^2)}{I1}}$$

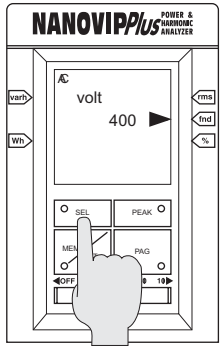


Percentage Total Harmonic Distortion Factor of the current in relation to the RMS value.
Varies from 0 to 100%. Updated every 24 seconds.
Release the SEL key to return to the previous page.

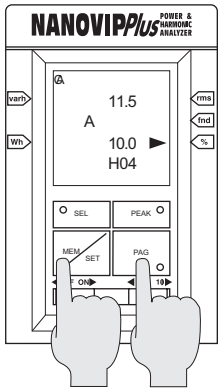
$$THD\ I = \sqrt{\frac{(S_{k=2,24}\ I_k^2)}{Irms}}$$



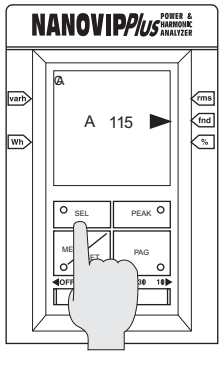
RMS value and percentage value in relation to the fundamental of the fourth voltage harmonic from 0 to 999%.
The MEM/SET key can be used to select Harm from 0 to 24, using an automatic harmonics scrolling mode. Press MEM/SET to stop the automatic scrolling. Keep SEL pressed to display the value of the fundamental.
Precision of harmonics measurements =
1% Rdg. + 0.6% F.S.



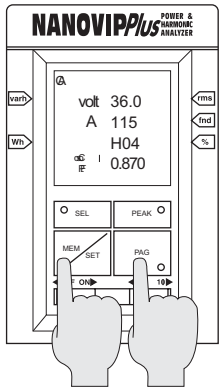
RMS value of the voltage fundamental.
Release SEL to return to the previous page.



RMS value and % in relation to the fundamental of the fourth current harmonic from 0 to 999%.
The MEM/SET key can be used to select Harm from 0 to 24, using an automatic harmonics scrolling mode. Press MEM/SET to stop the automatic scrolling. Keep SEL pressed to display the value of the fundamental (one stable reading).
Press PAG to move forward through the menu.
Precision of harmonics measurements =
1% Rdg. + 0.6% F.S.

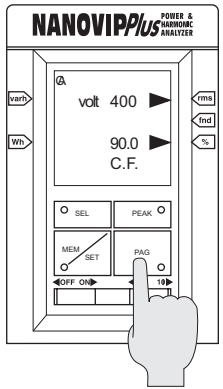


RMS value of the fundamental of the fourth current harmonic.
Release SEL to return to the previous page.

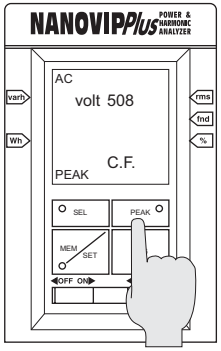


RMS value of the fourth voltage and current harmonic and relative cosØ. The MEM/SET key can be used to select Harm from 0 to 24, using an automatic harmonics scrolling mode. Press MEM/SET again to stop the automatic scrolling. Press PAG to move forward through the menu.

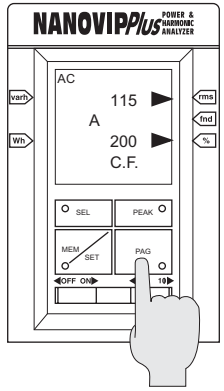
N.B.: The sign of the CosØ; as in the HARMONICS BLACK BOX, indicates the direction of the harmonic power. In addition, this Cosø measurement is not affected by the mode (three-phase/single-phase) (1ø/3ø).



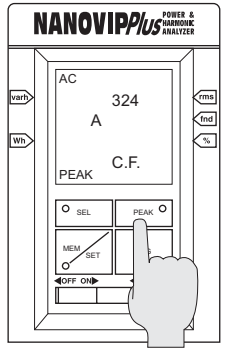
RMS value and percentage value of the voltage Crest Factor standardised to 100 = 100 * Crest / (1.41 * RMS) (from 70 to 999.9%).
Keep the PEAK key to display the absolute value of the crest value, the maximum value of the voltage waveform.
Press PAG. to move on to the next page.



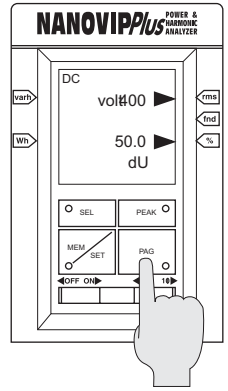
Crest Value, maximum value of the voltage waveform.
Release PEAK to return to the previous page.



RMS value and percentage value of the current
Crest Factor standardised to 100 = 100 * Crest / (1.41 * RMS) (from 70 to 999.9%).
Keep the PEAK key to display the absolute value of the crest value, the maximum value of the current waveform (one stable reading)
Press PAG. to move on to the next page.



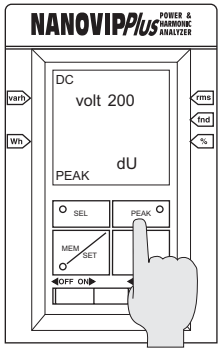
Crest Value, maximum value of the current waveform.
Release PEAK to return to the previous page.



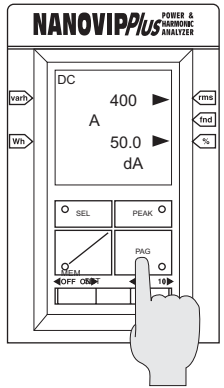
RMS value and percentage value in relation to the DC component of the voltage ripple from 0 to 999.9%.
Updated every 24 seconds.

$$dU = \sqrt{\frac{(S_{k=1,24} V_k^2)}{VDC}}$$

Keep the PEAK key pressed to display the effective value of the Ripple (one stable reading).
Press PAGE to move forward through the menu.



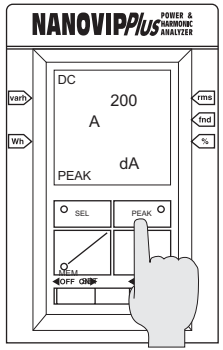
Effective value of the voltage ripple.
Release PEAK to return to the previous page.



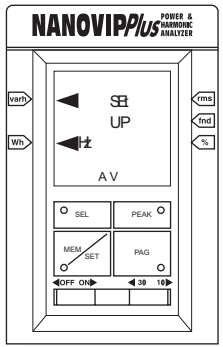
RMS value and percentage value in relation to the DC component of the current ripple from 0 to 999.9%.
Updated every 24 seconds.

$$dA = \sqrt{\frac{(S_{k=1,24} A_k^2)}{ADC}}$$

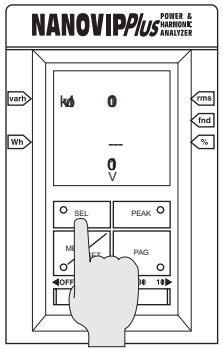
Keep the PEAK key pressed to display the effective value of the Ripple (one stable reading).
Press PAGE to move forward through the menu.



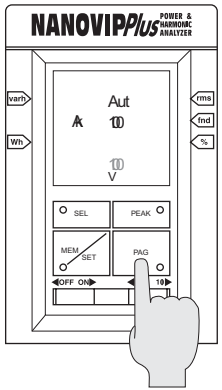
Effective value of the current ripple.
Release PEAK to return to the previous page.



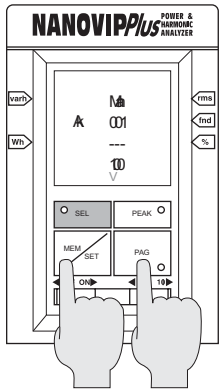
SET UP menu.
To access the menu press SEL.
To scroll through the list of menus press the PAG key again.



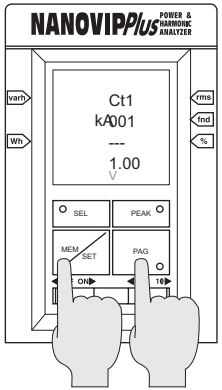
Setting at 10000 / 100V of the voltage measurement transformer.
The values of each figure of the primary are set using the SEL + MEM/SET keys (see page 45).
The following options are available for setting the exponent: k, k with 1 decimal, k with 2 decimals; the same also applies for the exponent blank.
The secondary may be (values of a list):
57.7, 63.5, 100, 110 115, 120, 173, 190, 200, 220 V. Press the PAG key to save the setting and move on to the next page.



Automatic setting of the primary of the current clamp meter at 1000 A or at 200 A depending on a jumper placed on the connector of the clamp meter itself (as already provided at present).
AUT is the only settable field. It can be modified using MEM/SET to allow the use of clamp meters different from the standard type, as the field after MANual mode shows.
The value 1000 A or 200 A cannot be edited.

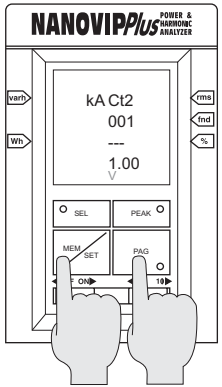


Setting at 1000 A of the current clamp meter or the current measurement transformer in MAN mode. The secondary of the clamp meter or transformer must be less than or equal to 1.00V if in voltage (e.g. clamp meter 500A/0.5V) or, if in current (5A or 1A) it can be adapted to 1.00V by means of INTA/5 or INTA/1. (E.g..1000A / 1V = 1000A/5A + INTA/5 o 1000A/1A + INTA/1). The values of each figure of the primary are set using SEL + MEM/SET. The exponent selection options are m, m with one decimal, or m with two decimals. The same also applies for the other exponents - blank, k. The secondary has decimal point in fixed position and first figure equal to 1 or 0.



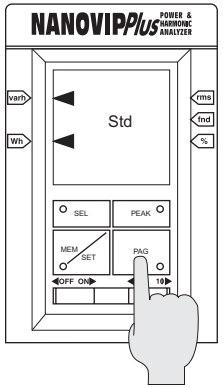
Setting of the first current clamp meter or the current measurement transformer. Access is using SET with the sequence: AUT, MAN, CT1. The only field which can be edited is CT1 / CT2; The values of the primary and secondary are those written in the 2 EEPROM tables written during the calibration phase, which can not be modified during the setup.

N.B.: this page is only present if enabled during calibration and checking.



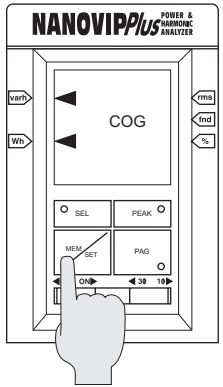
Setting of the second current clamp meter or the current measurement transformer. Access is using SET with the sequence: AUT, MAN, CT1, CT2. The only field which can be edited is CT1 / CT2; The values of the primary and secondary are those written in the 2 EEPROM tables written during the calibration phase, which can not be modified during the setup.

N.B.: this page is only present if enabled during calibration and checking.



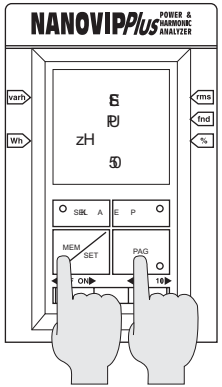
Selection of the type of the Energy Meters: Standard or Cogeneration (COG), i.e.:
positive and negative kWh (Import/Export)
positive and negative kvarh (Inductive/Capacitative)
The selection is made using MEM/SET.
Confirm using PAGE.

N.B.: COG is only valid in single-phase switching.

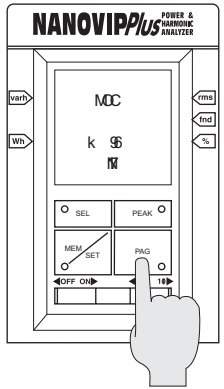


Selection of the type of the Energy Meters; Standard or COG.
The selection is made using MEM/SET.
Confirm using PAGE.

N.B.: COG is only valid in single-phase switching.
To exit from this menu keep the PAG key pressed for at least 3 seconds.

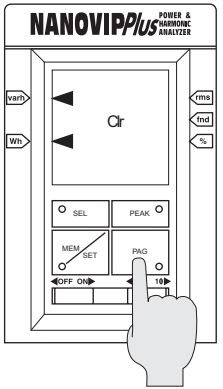


Harmonics analysis frequency SET UP menu.
The selection is made using the MEM/SET key, with the following options:
- OFF (harmonics analysis disabled by default)
- 50 Hz or 60 Hz (frequency of the fundamental).
(Beep on every 24 sec. at every ripple and THD refresh).
To scroll through the list of menus press PAG again.

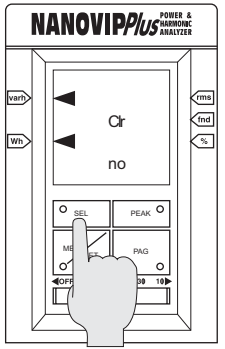


COM SETUP
19.2, 9.6, 4.8, 2.4, 1.2 kbaud (k fixed); 7,8 data bits;
Odd, Even, no parity; 1,2 stop bit.
To set, use the SEL and MEM/SET keys.
The value is acquired at the page change.

6 RESET MENU



Energy Meters RESET menu
To enter the reset page press SEL.
To exit from this menu keep the PAG key pressed for at least 3 seconds.



Energy Meters RESET page
The NO/YES selection is made using MEM/SET.
Confirmation always takes place after the PAG key has been pressed.
To exit, press PAG for at least 3 seconds.

7 SERIAL COMMUNICATIONS PROTOCOL

Modbus strings for Nanovip Plus Measurement request

ASCII string for Request for all Measurements:

: 01 03 0202 0049 AF cr lf

where:

:	=	Modbus string start
01	=	default address
03	=	data reading command
0202	=	hex address of data reading start
0049	=	hex number words to be read (73 words of data)
AF	=	check-sum

ASCII string for Nanovip Plus reply:

:01 03 92 D1..D146 check-sum cr lf

92 = hex number bytes to be read (146 dec.)

D1, D2, D3 = lsb (bcd), msb (bcd), exp (decimal) [volt]
D4, D5, D6 = lsb (bcd), msb (bcd), exp (decimal) [amps]
D7, D8, D9 = lsb (bcd), msb (bcd), exp (decimal) [watt]
D10, D11, D12 = lsb (bcd), msb (bcd), exp (decimal) [P.F.]

D13, D14, D15 = lsb (bcd), msb (bcd), exp (decimal) [var]
D16, D17, D18 = lsb (bcd), msb (bcd), exp (decimal) [VA]
D19, D20, D21 = lsb (bcd), msb (bcd), exp (decimal) [hertz]

D22,D23,D24,D25,D26 = lsb(bcd),(bcd),msb(bcd), positive sign(=00 hex), exp(decimal) [positive kwatthour]
D27,D28,D29,D30,D31 = (lsb bcd),(bcd),msb(bcd), positive sign(=00 hex), exp(decimal) [positive kvarhour]
D32,D33,D34,D35,D36 = lsb(bcd),(bcd),msb(bcd), negative sign(=80 hex), exp(decimal) [negative kwatthour]
D37,D38,D39,D40,D41 = lsb(bcd),(bcd),msb(bcd), negative sign(=80 hex), exp(decimal) [negative kvarhour]

D42, D43, D44 = lsb (bcd), msb (bcd), exp (decimal) [volt] saved in "PEAK" mode
D45, D46, D47 = lsb (bcd), msb (bcd), exp (decimal) [amps] saved in "PEAK" mode
D48, D49, D50 = lsb (bcd), msb (bcd), exp (decimal) [watt] saved in "PEAK" mode
D51, D52, D53 = lsb (bcd), msb (bcd), exp (decimal) [P.F.] saved in "PEAK" mode
D54, D55, D56 = lsb (bcd), msb (bcd), exp (decimal) [var] saved in "PEAK" mode
D57, D58, D59 = lsb (bcd), msb (bcd), exp (decimal) [VA] saved in "PEAK" mode
D60, D61, D62 = lsb (bcd), msb (bcd), exp (decimal) [hertz] saved in "PEAK" mode

D63, D64, D65 = lsb (bcd), msb (bcd), exp (decimal) [volt] saved in "MEM" mode
D66, D67, D68 = lsb (bcd), msb (bcd), exp (decimal) [amps] saved in "MEM" mode
D69, D70, D71 = lsb (bcd), msb (bcd), exp (decimal) [watt] saved in "MEM" mode
D72, D73, D74 = lsb (bcd), msb (bcd), exp (decimal) [P.F.] saved in "MEM" mode
D75, D76, D77 = lsb (bcd), msb (bcd), exp (decimal) [volt] variation in "MEM" mode
D78, D79, D80 = lsb (bcd), msb (bcd), exp (decimal) [amps] variation in "MEM" mode
D81, D82, D83 = lsb (bcd), msb (bcd), exp (decimal) [watt] variation in "MEM" mode

D84,D85,D86 = lsb(bcd), msb(bcd), exp(decimal) [ThdV] V total harmonic distortion factor (ref. fundamental)

D87,D88,D89 = lsb(bcd), msb(bcd), exp(decimal) [ThdV] V total harmonic distortion factor (ref. RMS value)
D90,D91,D92 = lsb(bcd), msb(bcd), exp(decimal) [ThdA] A total harmonic distortion factor (ref. fundamental)
D93,D94,D95 = lsb(bcd), msb(bcd), exp(decimal) [ThdA] A total harmonic distortion factor (ref. RMS value)

D96, D97, D98 = lsb (bcd), msb (bcd), exp (decimal) [volt] Crest Value
D99, D100, D101 = lsb (bcd), msb (bcd), exp (decimal) [volt] % Crest Value
D102, D103, D104 = lsb (bcd), msb (bcd), exp (decimal) [amps] Crest Value
D105, D106, D107 = lsb (bcd), msb (bcd), exp (decimal) [amps] % Crest Value

D108, D109, D110 = lsb (bcd), msb (bcd), exp (decimal) [VDC ripple]
D111, D112, D113 = lsb (bcd), msb (bcd), exp (decimal) [% VDC ripple]
D114, D115, D116 = lsb (bcd), msb (bcd), exp (decimal) [ADC ripple]
D117, D118, D119 = lsb (bcd), msb (bcd), exp (decimal) [% ADC ripple]

D120 = harmonic n selected (from 0 to 24) (decimal)
D121,D122,D123 = lsb(bcd), msb(bcd), exp(decimal) [harmonic n volt]
D124,D125,D126 = lsb(bcd), msb(bcd), exp(decimal) [% harmonic n volt ref. to fundamental]
D127,D128,D129 = lsb(bcd), msb(bcd), exp(decimal) [harmonic n amps]
D130,D131,D132 = lsb(bcd), msb(bcd), exp(decimal) [% harmonic n amps ref. to fundamental]
D133,D134,D135 = lsb(bcd), msb(bcd), exp(decimal) [cosphi harmonic n]
D136,D137,D138 = lsb(bcd), msb(bcd), exp(decimal) [volt fundamental]
D139,D140,D141 = lsb(bcd), msb(bcd), exp(decimal) [amps fundamental]
D142,D143,D144 = lsb(bcd), msb(bcd), exp(decimal) [cosphi fundamental]
D145,D146 = Status bytes (see below)

/------------------------/

ASCII string for Request for Main Measurements and Meters:

: 01 03 0202 0015 E3 cr lf

where:

:	=	Modbus string start
01	=	default address
03	=	data reading command
0202	=	hex address of data reading start
0015	=	hex number words to be read (21 words of data)
E3	=	check-sum

ASCII string for Nanovip Plus reply :

:01 03 2A D1..D42 check-sum cr lf

2A = hex number bytes to be read (42 dec.)

D1, D2, D3 = lsb (bcd), msb (bcd), exp (decimal) [volt]
D4, D5, D6 = lsb (bcd), msb (bcd), exp (decimal) [amps]
D7, D8, D9 = lsb (bcd), msb (bcd), exp (decimal) [watt]
D10, D11, D12 = lsb (bcd), msb (bcd), exp (decimal) [P.F.]
D13, D14, D15 = lsb (bcd), msb (bcd), exp (decimal) [var]
D16, D17, D18 = lsb (bcd), msb (bcd), exp (decimal) [VA]
D19, D20, D21 = lsb (bcd), msb (bcd), exp (decimal) [hertz]

D22,D23,D24,D25,D26 = lsb(bcd),(bcd),msb(bcd), positive sign (=00 hex), exp(decimal) [positive kwatthour]
D27,D28,D29,D30,D31 = lsb(bcd),(bcd),msb(bcd), positive sign (=00 hex), exp(decimal) [positive kvarhour]

D32,D33,D34,D35,D36 = lsb(bcd),(bcd),msb(bcd), negative sign (=80 hex), exp(decimal) [negative kwatthour]
D37,D38,D39,D40,D41 = lsb(bcd),(bcd),msb(bcd), negative sign (=80 hex), exp(decimal) [negative kvarhour]

D42= meaningless (lsb volt in "PEAK" mode)

Example:

V	=	230	V	(30 02 00)
I	=	50	A	(00 05 FF)
W	=	5.73	kW	(73 05 01)
P.F.	=	0.50		(00 05 FD)
var	=	9.96	kvar	(96 09 01)
VA	=	11.5	kVA	(15 01 02)
hertz	=	50.0	Hz	(00 05 FF)
kwatthour	=	4.538	kWh+	(38 45 00 00 FD)
kvarhour	=	0.986	kvarh+	(86 09 00 00 FD)
kwatthour	=	- 0.000	kWh-	(00 00 00 80 FD)
kvarhour	=	- 0.039	kvarh-	(39 00 00 80 FD)

/-------------------------/

ASCII string for Request for “PEAK” Measurements:

: 01 03 022B 000B C4 cr lf

where:
: = Modbus string start

01 = default address
03 = data reading command
022B = hex address of data reading start
000B = hex number words to be read (11 words of data)
C4 = check-sum

ASCII string for Nanovip Plus reply:

:01 03 16 D1..D22 check-sum cr lf

16 = hex number bytes to be read (22 dec.)

D1, D2, D3 = lsb (bcd), msb (bcd), exp (decimal) [volt] saved in "PEAK" mode
D4, D5, D6 = lsb (bcd), msb (bcd), exp (decimal) [amps] saved in "PEAK" mode
D7, D8, D9 = lsb (bcd), msb (bcd), exp (decimal) [watt] saved in "PEAK" mode
D10, D11, D12 = lsb (bcd), msb (bcd), exp (decimal) [P.F.] saved in "PEAK" mode
D13, D14, D15 = lsb (bcd), msb (bcd), exp (decimal) [var] saved in "PEAK" mode
D16, D17, D18 = lsb (bcd), msb (bcd), exp (decimal) [VA] saved in "PEAK" mode
D19, D20, D21 = lsb (bcd), msb (bcd), exp (decimal) [hertz] saved in "PEAK" mode

D22= meaningless (lsb volt saved in "MEM" mode)

/-------------------------/

ASCII string for Request for “MEM” measurements:

: 01 03 0240 000B AF cr lf

where:

:	=	Modbus string start
01	=	default address
03	=	data reading command
0240	=	hex address of data reading start
000B	=	hex number words to be read (11 words of data)
AF	=	check-sum

ASCII string for Nanovip Plus reply:

:01 03 16 D1..D22 check-sum cr lf

16 = hex number bytes to be read (22 dec.)

D1, D2, D3 = lsb (bcd), msb (bcd), exp (decimal) [volt] saved in "MEM" mode
D4, D5, D6 = lsb (bcd), msb (bcd), exp (decimal) [amps] saved in "MEM" mode
D7, D8, D9 = lsb (bcd), msb (bcd), exp (decimal) [watt] saved in "MEM" mode
D10, D11, D12 = lsb (bcd), msb (bcd), exp (decimal) [P.F.] saved in "MEM" mode
D13, D14, D15 = lsb (bcd), msb (bcd), exp (decimal) [volt] variation in "MEM" mode
D16, D17, D18 = lsb (bcd), msb (bcd), exp (decimal) [amps] variation in "MEM" mode
D19, D20, D21 = lsb (bcd), msb (bcd), exp (decimal) [watt] variation in "MEM" mode

D22= meaningless (lsb THDV)

/-------------------------/

ASCII string for Request for THDV and DC Ripple measurements:

: 01 03 0255 0012 93 cr lf

where:

:	=	Modbus string start
01	=	default address
03	=	data reading command
0255	=	hex address of data reading start
0012	=	hex number words to be read (18 words of data)
93	=	check-sum

ASCII string for Nanovip Plus reply:

:01 03 24 D1..D36 check-sum cr lf

24 = hex number bytes to be read (36 dec.)

D1, D2, D3 = lsb(bcd), msb(bcd), exp(decimal) [ThdV] V total harmonic distortion factor (ref. fundamental)
D4, D5, D6 = lsb(bcd), msb(bcd), exp(decimal) [ThdV] V total harmonic distortion factor (ref. RMS)
D7, D8, D9 = lsb(bcd), msb(bcd), exp(decimal) [ThdA] A total harmonic distortion factor (ref. fundamental)
D10,D11,D12 = lsb(bcd), msb(bcd), exp(decimal) [ThdA] A total harmonic distortion factor (ref. RMS)

D13, D14, D15 = lsb (bcd), msb (bcd), exp (decimal) [volt] Crest Value
D16, D17, D18 = lsb (bcd), msb (bcd), exp (decimal) [volt] % Crest Value
D19, D20, D21 = lsb (bcd), msb (bcd), exp (decimal) [amps] Crest Value
D22, D23, D24 = lsb (bcd), msb (bcd), exp (decimal) [amps] % Crest Value

D25, D26, D27 = lsb (bcd), msb (bcd), exp (decimal) [VDC ripple]
D28, D29, D30 = lsb (bcd), msb (bcd), exp (decimal) [% VDC ripple]

D31, D32, D33 = lsb (bcd), msb (bcd), exp (decimal) [ADC ripple]
D34, D35, D36 = lsb (bcd), msb (bcd), exp (decimal) [% ADC ripple]

/------------------------/

ASCII string for Request for Harmonic Measurements:

: 01 03 0279 000D 74 cr lf

where:

:	=	Modbus string start
01	=	default address
03	=	data reading command
0279	=	hex address of data reading start
000D	=	hex number words to be read (13 words of data)
74	=	check-sum

ASCII string for Nanovip Plus reply:

:01 03 1A D1..D26 check-sum cr lf

1A = hex number bytes to be read (26 dec.)

D1 = harmonic n selected (from 0 to 24) (decimal)
D2, D3, D4 = lsb (bcd), msb (bcd), exp (decimal) [harmonic n volt]
D5, D6, D7 = lsb (bcd), msb (bcd), exp (decimal) [% harmonic n volt ref. to fundamental]
D8, D9, D10 = lsb (bcd), msb (bcd), exp (decimal) [harmonic n amps]
D11, D12, D13 = lsb (bcd), msb (bcd), exp (decimal) [% harmonic n amps ref. to fundamental]

D14, D15, D16 = lsb (bcd), msb (bcd), exp (decimal) [cosphi harmonic n]
D17, D18, D19 = lsb (bcd), msb (bcd), exp (decimal) [volt fundamental]
D20, D21, D22 = lsb (bcd), msb (bcd), exp (decimal) [amps fundamental]
D23, D24, D25 = lsb (bcd), msb (bcd), exp (decimal) [cosphi fundamental]

D26= meaningless

RS232 CABLE

NANOVIP
9 PIN CANON
MALE

PIN	FUNCTION	PIN
1	N.C.	N.C.
2	RX TX	3
3	TX RX	2
4	N.C.	N.C.
5	GND GND	5
6	N.C.	N.C.
7	N.C.	N.C.
8	N.C.	N.C.
9	N.C.	N.C.

PC
9 PIN CANON
FEMALE

LIST OF ERROR STRINGS IMPLEMENTED AND THEIR MEANING.

- ILLEGAL FUNCTION
Error generated by reception of an unknown function code.

P.C. NANOVIP

<------- :,AA,FF,01H,LRC,CR,LF

where:
- AA = NANOVIP PLUS default address (01)
- FF = Code of the command received with bit 7 forced to 1 (2 bytes ascii);e.g. 81H: code of the command for reading of 1 bit (not recognised)
- LRC = Longitudinal Redundancy Check (2 bytes ascii)
- CR = 0DH (1 byte ascii)
- LF = 0AH (1 byte ascii)

- ILLEGAL DATA ADDRESS
Error generated by reception of an address relating to the data which is outside the valid range set for that type of command.

E.g.
In a command for reading of N words, if address > 0292 H this type of error is generated.

P.C. NANOVIP

<------- :,AA,FF,02H,LRC,CR,LF

where:
- AA = NANOVIP PLUS default address (01)
- FF = Code of the command received with bit 7 forced to 1 (2 bytes ascii); e.g. 83H (84H): code of the command to read N words
- LRC = Longitudinal Redundancy Check (2 bytes ascii)
- CR = 0DH (1 byte ascii)
- LF = 0AH (1 byte ascii)

- ILLEGAL DATA VALUE
Error generated by reception of a datum which is outside the valid range established for that type of command.

E.g.
In a command for reading of N words, if number of word to be read > 0049 hex (73 dec.) this type of error is generated.

P.C. NANOVIP

<------- :,AA,FF,03H,LRC,CR,LF

where:
- AA = NANOVIP PLUS default address (01)
- FF = Code of the command received with bit 7 forced to 1 (2 bytes ascii); e.g. 83H (84H): code of the command to read N words

- LRC = Longitudinal Redundancy Check (2 bytes ascii)
- CR = 0DH (1 byte ascii)
- LF = 0AH (1 byte ascii)

- FAILURE IN ASSOCIATED DEVICE
Error generated by reception of a non hexadecimal (ascii) character.
The valid Hex characters are: 0-9, A-F.

P.C. NANOVIP

<------- :,AA,FF,04H,LRC,CR,LF

where:
- AA = NANOVIP PLUS default address (01)
- FF = Code of the command received with bit 7 forced to 1 (2 bytes ascii);
  e.g. 83H (84H): code of the command for reading of N words
- LRC = Longitudinal Redundancy Check (2 bytes ascii)
- CR = 0DH (1 byte ascii)
- LF = 0AH (1 byte ascii)

- NO RESPONSE
Communications error generated by:
- Overrun or framing error
- Incorrect initial character (":")
- Selected address not valid

- LRC error
- CR error
- LF error

HOW THE “LRC” IS CALCULATED.
The LRC is calculated as follows:
- all the bytes for transmission before the LRC, with the sole exception of the string start character (“”) are added together.
- the value calculated is then divided by 256 and the remainder is noted.
- the remainder is then subtracted from 256 to obtain the desired LRC.

Example:
:,01H,03H,FE00H,0021H,LRC,CR,LF

The LRC will be calculated as follows:
- 01H + 03H + FEH + 00H + 00H + 21H = 123H (291)
- 123H / 100H (256) = 01H REMAINDER = 23H (35)
- 100H (256) - 23H = DDH

therefore:
- LRC = DDH.

MEANING OF THE STATUS BYTES

BYTE D145:

bit 0 = service bit

bit 1 = service bit

bit 2 = autclamp meter (bit 2 = 0 means default automatic clamp meter, i.e. with full scale 1000A
(bit 2 = 1 means alternative clamp meter)

bit 3 = acdc (bit 3 = 1 means measurement in AC)
(bit 3 = 0 means measurement in DC)

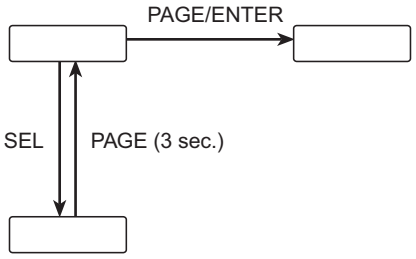
bit 4 = (bit 4 = 1 means no signal (voltage and current)
(bit 4 = 0 means there is at least one valid signal (voltage or current or both)

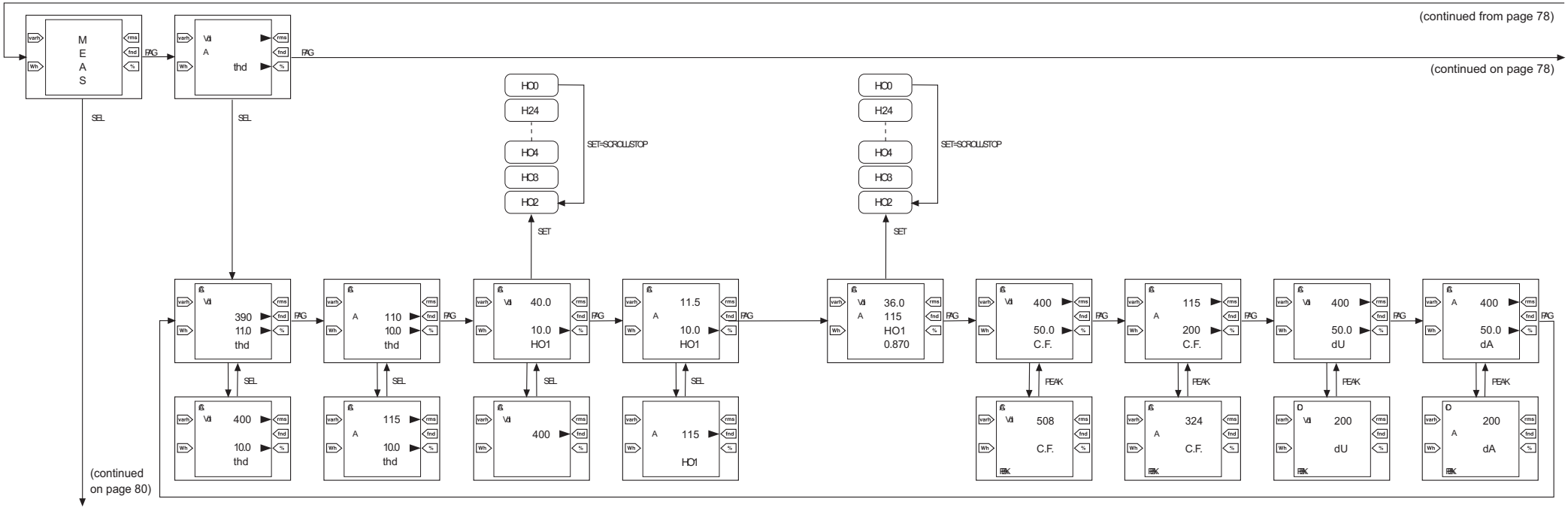
bit 5 = single3ph (bit 5 = 0 means single-phase measurement
(bit 5 = 1 means three-phase measurement in quadrature).

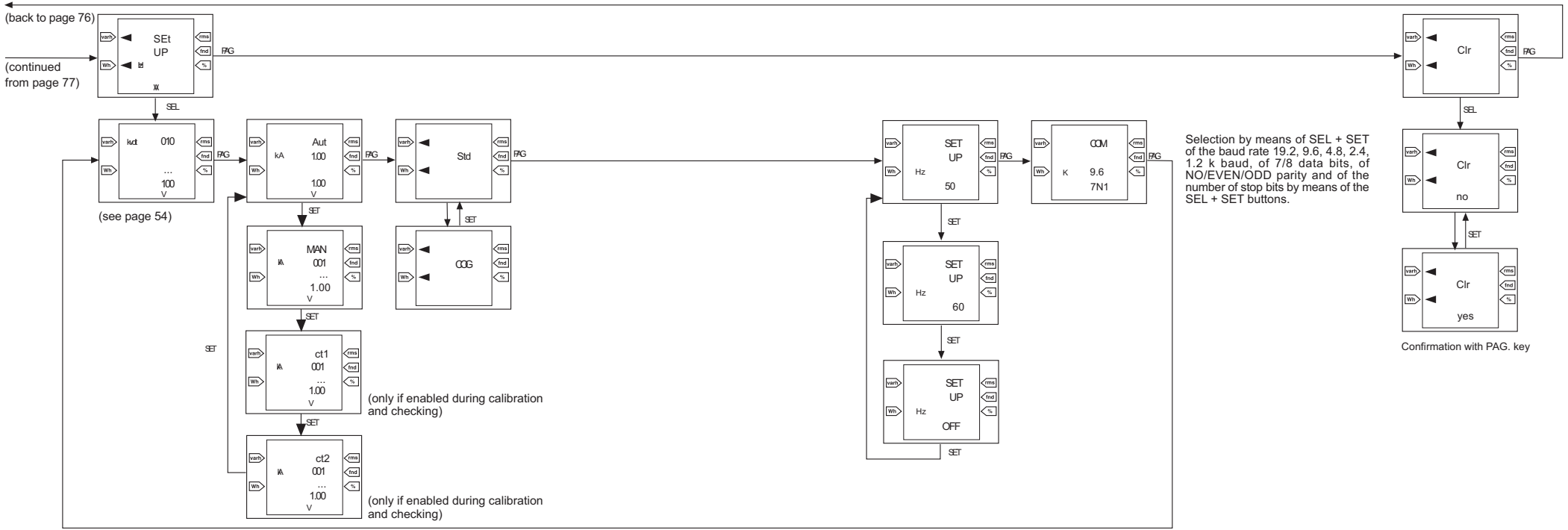
bit 6 = batt (bit 6 = 1 means battery flat)
(bit 6 = 0 means battery charged)

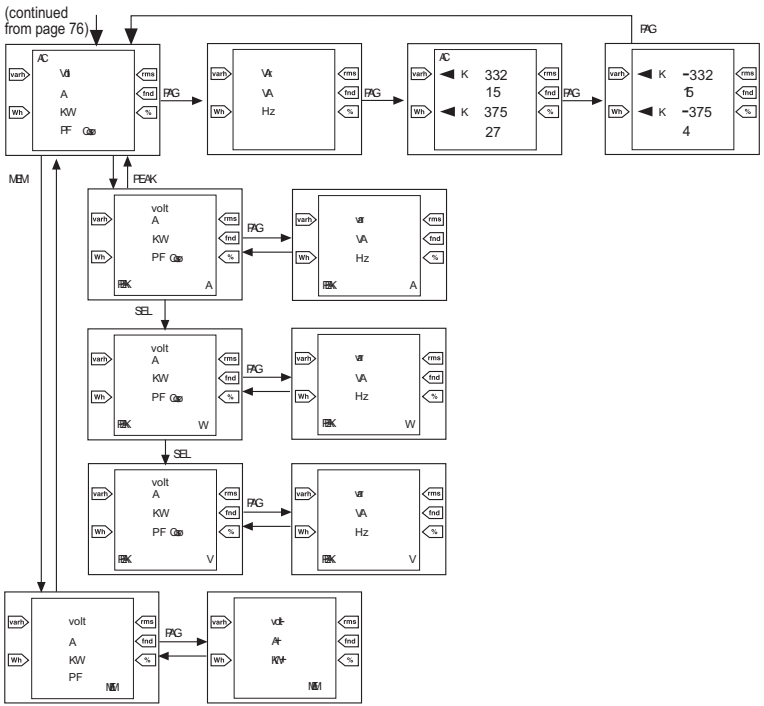
bit 7 = (service bit)

BYTE D146 = (service byte)

FUNCTION	PUSHBUTTONS TO BE USED
MOVING ON THE SAME MENU LEVEL	
PASSAGE TO A LOWER MENU LEVEL	
EDITING	SEL + SET = SEL = select digit, SET = change digit SET = change value
ESCAPE TO AN UPPER MENU LEVEL	PAGE/ENTER (for 3 sec.)


(continued from page 78)
(continued on page 78)
MEAS
PAG
SEL
thd
HC0
H24
HO4
HO3
HO2
SET
SET=SCROLLSTOP
390
11.0
40.0
10.0
HO1
11.5
36.0
115
0.870
400
50.0
C.F.
200
dU
dA
PEAK
508
324
(continued on page 80)


(back to page 76)
(continued from page 77)
SEt
UP
PAG
SEL
kct
010
...
100
V
(see page 54)
Aut
kA
1.00
1.00
V
Std
COG
MAN
001
...
1.00
ct1
ct2
SET
(only if enabled during calibration and checking)
(only if enabled during calibration and checking)
SET
UP
Hz
50
60
OFF
COM
K
9.6
7N1
Selection by means of SEL + SET of the baud rate 19.2, 9.6, 4.8, 2.4, 1.2 k baud, of 7/8 data bits, of NO/EVEN/ODD parity and of the number of stop bits by means of the SEL + SET buttons.
Clr
no
yes
Confirmation with PAG. key


(continued from page 76)
AC
varh
Wh
rms
fnd
%
PAG
MEM
PEAK
SEL
volt
A
KW
PF
var
VA
Hz
K
332
15
375
27
-332
15
-375
4
W
V